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*The Observations of the SPOTS of the SUN, made at the Royal Academy at Paris, Continued * ; and English'd out of French.*

* See the Beginning of them in Numb. 75.

HAVING formerly communicated the Observations of the New Spots in the Sun, together with Signor Cassini's way of noting their situation in his disque ; which hath served to determine the Time when they should be visible on its apparent surface, and how long they should remain on his hidden Hemisphere before their re-appearing to us, and lastly to calculate the duration of their Periodical Revolution about his Axis ; it may justly be exspect'd, we should give the Sequel of what hath been observed since the first and last appearance of these Spots.

It hath been noted in the first Paper, that in the last Observation, made the *thirteenth of August*, the Anterior Limb of the Misty Crown enclosing all the Spots, was in the same Horary Circle with the Sun's center.

In the morning of the *fourteenth of the same Month*, from six to seven a clock, there passed $15''$ of time between the passage of the Anterior limb of the said Crown, and the passage of the Sun's center through the same Horary Circle : And then the Southern limb of the Crown was a *minute* and a *half* distant, toward the North, from the parallel of the Equator, passing through the same Center of the Sun. The Figure of the first Spot was almost the same with that of the day before. The second had taken the form of an Heart, the point of which was turned to the North side, and its base between the South and the East. Three other small spots, disposed Triangle-wise, stood over the said base, and were accompanied with two others upon a line turned South ward. And they were all encompassed by a Crown running out into a point on the South side ; and on the North side, East ward, it had an *Appendix*, as is represented in Tab. I. Fig. I.

The *fifteenth*, at six in the morning, there passed $27''$ between the passage of the Anterior limb of the Crown, and that of the Sun's Center through the same Horary circle. The Southern limb

limb of the same Crown was *two minutes* and *an half* distant from the parallel of the *Equator* passing through the center of the Sun, whose Diameter pass'd in $2^{\circ} 9''$. through the same Horary circle. The first Spot had a little changed its figure ; the second was quadrangular, longer from East to West, than from North to South ; It appeared bigger than ordinary, and had withall on its sides, within the compas of the Crown, three other small spots. There were also seen four more without the said Crown on the South-side ; as they are marked in *Tab. I. Fig. 2.*

The *Sixteenth*, at six in the morning, there wete $27''$ between the passage of the Suns Anterior limb, and the passage of the Anterior limb of the Crown through the same Horary circle ; and $38''$ between the passage of the anterior limb of the Crown, unto the passage of the Sun's center. The Southern Limb of the Crown was $\frac{3}{2}$ off from the parallel of the *Equator*, passing through the Center of the Sun towards the North. And the Observation having been made yet more exactly at half an hour past seven of the same morning, this distance was found of $3' 33''$. The Figure of the first Spot in the beginning of the Observation differ'd not much from that of the precedent day ; but afterwards it was seen divided into two. The second, which likewise seemed to be the same in the beginning, was afterwards divided into three, accompanied with black and dark points without the Crown on the South-side, as may be seen in *Tab. I. Fig. 3* and *4.*

The *same day*, at six a clock and $15'$. at night, the figures of these Spots were much changed. They appeared of the shape, as we have endeavoured to represent them in *Tab. I. Fig. 5* ; where there are Five Spots enclosed in the Crown. The two fore-most were part of that which had been seen in the morning as one ; the two others following those two first, were part of the second in the morning ; and without, there were five points on the South side ; and two more, a little further to the North ; which points were ranged as in another *area* made up of other points so small, that they could scarce be perceived ; and the Engraver hath been obliged (to make them perceptible) to represent them much greater than they were.

The *Seventeenth* in the morning, immediatly after the rising of the Sun, there appeared three very dark Spots, which form'd in a manner these Letters, *F, n, J,* posited from East to West, and included in their wonted Crown, which stretched out, as 'twere, two Arms, or two Handles, one to the South, and the other to the North. There lapsed 18". between the passage of the foremost limb of the Sun, and that of the foremost limb of the Crown, and $47\frac{1}{2}$ " between the passage of the anterior limb of the Crown unto the passage of the Sun's Center. The Southern limb of the same Crown was distant 11'.17" from the parallel that touched the Sun on the North-side, and 4'.38" from the parallel that passed through his Center. See Tab. I.

Fig. 6.

The *Eighteenth*, at seven in the morning, the Spots, which appeared through some clouds, had almost the same shape with those of the day before, only with this difference, that they were a little closer together, drawing from East to West. There is here no particular description exhibited of them, for fear of failing in their exactness, by reason of the clouds which hindered to see them distinctly. There lapsed 13". between the passage of the anterior limb of the Sun, and that of the anterior limb of the Spot, through the same Horary circle, and $52\frac{1}{2}$ " of the foremost limb of the Spot un'o the passage of the Center. The Southern limb of the Spot was 9'.13" distant from the parallel that touched the Northern limb of the Sun, and 6'.41" from the parallel that passed through his Center. This Observation was ended between 7 and 8 in the morning.

At five a clock and 55'. at night of the same day, the Spots appeared as in Tab. I. Fig. 7. There lapsed 11". between the passage of the anterior limb of the Sun, through the same horary circle, and the passage of the anterior limb of the Crown, and from thence unto the passage of the Suns center, $54\frac{1}{2}$ ". The limb of the Crown next to the parallel passing through the center of the Sun, was distant from the same parallel, 7'.40".

From four a clock to five in the evening of the *Nineteenth*, the Spot was observed whilst the Sun was emerging out of Clouds. It appeared oblong near the Suns Circumference; from which it was distant about the breadth of the same Spot,

as appears in *Tab. I. Fig. 8.* And when we were preparing to measure its distance from the parallel of the Diurnal motion of the Suns Center, the Clouds, which rose from the *Horizon*, intercepted it from our sight.

The apparent velocity of the Spots when they approached to the Suns center, (which had been noted in the first Discourse) gave ground to determin their apparent Periodical Revolution about the Suns Axe about *Twenty seven days and an half*, supposing them to be adherent to his Surface, or at least very nigh to it; and consequently that from the morning of the 13th of *August*, when they were near his center, they should take between six and seven days to arrive at the limb of his apparent disque: the which hath come to pass conformably to the Observations made since that time. For, since the morning of the 13th unto the evening of the 19th, when they were seen nigh the limb, there are $6\frac{1}{2}$ days; and then they were yet so far distant from it, that it was easie to Judge, they would not come out that day. The Clouds and Night did then hinder to observe them; but in the morning of the 20th, which was not the full seventh from the day that they were arrived to the middle of the disque, they were disappeared. This likewise agrees well enough with what had been practised, viz. that these Spots during the fourth part of the time of their motion about the Suns center, calculated according to this *Hypothesis*, and upon the first Observations, would remain in the *Western Quadrant*.

The apparent Velocity nigh the Center was such that if it had continued the same, the Spots would have arrived almost in four days to the Limb of the disque; but in this *Hypothesis* this apparent velocity was to lessen according as the Spots should remove from the Center; as hath come to passe in eff. &c. The diminution of the Length of the Misty Crown was in a manner proportionat to the diminution of the apparent Velocity; since that, when this Crown was in the midle, and in a situation, wherein its true figure could be best seen, it appeared oblong, and of the form of an human Ear, its greatest diameter respecting East and West; but being nigh the Limb, this same diameter seemed to shorten; and having appeared greatest

in its first situation, it appeared least in this, because it was almost in a circle that passed through the center of the Sun, whose equal arches are by so much the more oblique, by how much they approach more to the limb of his disque, and consequently appear less, according to the rules of Opticks; mean time the diameter, that was turned from South to North, apparently kept the same bigness it had near the center, because it was in a circle almost parallel to the *horizon* of the Sun, which formed the representation of its limb, and whose equal arches (by the same Optical reasons) do not appear contracted.

Observations concerning Saturn, made in the same place with the former.

AT the same time that the *New Spots* of the Sun began to appear, Signor *Cassini* observed in Saturn also something remarkable, in regard of the un-expected Change of his Figure. Astronomers know, that this Planet is for the most part seen with Arms or *Anses* fastned to the two sides of his disque, when he is beheld with some great Telescope; and that he retaketh not his *Round Figure*, but every fifteenth year. This Change was to come to pass this present year, and Saturn to appear in that Round Figure, without his *Anses* or Handles, according to the *Hypothesis* and Predictions of M. *Hugens*, publish't A. 1659; which indeed hath so hapned, but not just within the time he had appointed: For this Spherical figure of *Saturn* should not have appeared, according to his suppositions, but in the month of *July* and *August*, and so coatinued for the rest of the time that *Saturn* was to be visible at this time, and even for a part of his appearance in the next year; but this Roundness hath been perceived sooner, and *Saturn* hath appeared orbicular since the end of *May*, at a time when he was distant enough from the Sun and the Horizon, to be well observed. He hath remained in this *figure* unto the *Eleventh* of *August*. The said Signor *Cassini* did then observe him thus; but three days after he saw him with *Arms*, though very narrow ones, which do still continue*. They are represented in *Tab. I. Fig. 9.*

* See M. *Hugens*'s Letter below.

Monsieur *Hugens* having examined these Appearances, and the Cause of the difference from what he predicted of them, finds not that they are contrary to his Hypothesis of the *Flat Ring* about Saturn, by the means of which he explicateth all the Changes of his figure; but he esteems, that they will serve to determine, more precisely than could be done hitherto, the several Appearances of this *Round figure*; and because he fore-seeth, that it will so appear again within a little time, and at the furthest in *December* next, and that the same will so continue the remaining time of its Appearance, he considers the Return of the Arms, which do at present appear, as a little interruption of this *Round figure*; which would not so much as have been perceived with middle-sized Glasses of 6 or 7 feet, like those that were used by *Galilæi* and *Gassendi*: which Experience may verifie, if instead of Telescopes of 15 or 20 feet long, you employ only some of these smaller ones, with which you are not able to discern these Arms because of their tenuity, and that they are but faintly illuminated by the Sun-beams, which do more obliquely fall upon the *flat surface* of the Ring.

Monsieur *Hugens* believeth also, that *Saturn* will appear the next Summer, after his Conjunction with the Sun, with Arms like those he hath now; in which he amends his Prediction of A. 1659; having seen by these last Observations (as he was already aware of it in his *Système*,) that this Round appearance is to be defin'd to a less number of degrees than he had done, in respect of great Telescopes.

Trans. N.^o 78

Tab. I

